Wetland plants in the desert

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Keywords: observations: *Utricularia macrorhiza* — travelogue: Nevada (USA), *Utricularia macrorhiza.*

The mystery began several years ago when one of us (BR) was reviewing the collections of a small herbarium in southern Arizona. Dry, hot, desert land does not have many aquatic plants, so the discovery of a slender folder of *Utricularia* sheets was unexpected. When *Utricularia* plants are found in the southwestern USA they are almost always *U. macrorhiza*, growing in the mountains that rise high above the desert floor. But one of the specimens, a thirty year old sheet of fragments described as having been collected in Duckwater, Nevada, was puzzling. This unidentified specimen consisted of just two short, bushy branches, each only 5 cm long. It did not look like *U. macrorhiza*, and it certainly did not seem likely to have been collected in Duckwater. Duckwater is in Shoshone Indian Territory. It is scrub desert, dry and dusty, a land of sagebrush, not *Utricularia.*

The herbarium sheet invited questions. Was the specimen correctly labelled? Did this aquatic plant really live in the desert? And was the specimen really *U. macrorhiza*, somehow weirdly distorted? Unfortunately the collection site was remote, so these questions were long unanswered.

In the summer of 1998 we planned a trip that would take us near Duckwater Indian Reservation, and which would offer us the perfect opportunity to explore this mystery. In anticipation we did a little preparatory research. We checked topographical maps and found that a "Little Warm Spring", mentioned on the herbarium label, did exist on the reservation. We then called the Duckwater headquarters and explained that we were interested in exploring the area for evidence of this carnivorous plant. Headquarters verified the existence of the spring, but could offer no information as to the presence of the plant. However, they did grant us permission to search for it and to collect specimens.

Early on the morning of August 15 we left northern California and drove to just west of Ely, Nevada. We arrived late in the evening and decided to camp in the desert. The next morning we made our plans for the drive to Duckwater. We chose the road that was most clearly marked on the map, noting that it would take us through the town of Hamilton where we could stop for gas. It looked like a fairly straightforward 72 km (45 mile) drive. We expected that it would take us about forty minutes to get to the reservation.

Shortly after we set out, our straightforward plan developed kinks. The rocky terrain grew very rough. The road we had chosen rapidly degenerated into an unfriendly trail that wound its way through the White Pine Mountains. We bounced through notch canyons full of rubble that had rolled down the mountainsides. Cows wandered about on the trail. We passed the crumbling remains of long-abandoned dwellings and a deserted mine surrounded by mounds of tailings—all that remained of "Hamilton, Nevada". No gas for sale here! As if to mirror our confusion, the road divided into a network of paths that twisted through the desert mountains. Maps being useless, we navigated by compass. For long stretches, washouts and boulder piles forced us to a crawl. Vultures hovered overhead. After two and a half jolting hours we had traveled only 40 km (25 miles). Gradually, however, the road improved: it smoothed and flattened, and the horizon opened around us. We were able to sit back, see where we were and enjoy the rest of the drive to Duckwater Indian Reservation.

Duckwater is weird. It is an alkaline desert in the undrained basin between the Sierra

Figure 1: *Utricularia macrorhiza* habitat (foreground) on the arid Duckwater Reservation. Photo by E. Salvia.

Figure 2: Dense accumulations of *U. macrorhiza* draped over rocks. Photo by E. Salvia.

Nevada in California and the Wasatch Range in Utah. Perched at an elevation of 1700 m (5600 ft), its topography consists of flat valleys separated by frequent mountain ranges that reach to even greater heights. It is dry, dusty, and covered with alkaline-loving plants like rabbitbrush, four-wing saltbush, and mormon tea (*Chrysothamnus nauseosus*, *Atriplex canescens*, and *Ephedra* spp., respectively). This is unlikely habitat for an acid-loving aquatic species and so, although we had been assured that some kind of wetland awaited us, we were prepared for disappointment.

Much to our surprise the wetland did exist. Here in the middle of this scrub desert was a small explosion of lush greenness on a gently sloping hillside. We explored the area and found a few small ponds, but they were fouled by cattle and were useless for carnivorous plants. A quick stream (probably artificially channeled by ranchers) descended the hill, and near the ponds fanned into a broad sheet of water which flowed over the desert hardpan. (This stream presumably drains from the mountain ranges to the northeast.) Grasses and sedges grew densely everywhere. On hands and knees, we searched this water-saturated area carefully for bladderworts. No luck. Still, we did not give up, for the wet slopes were bright with yellow monkey flower (*Mimulus* spp.), and this genus often occurs with *Utricularia*.

Further downhill, the sheeting water coalesced back into a braided network of fast-flowing streamlets, each only 45 cm (18 inches) wide and 30 cm (12 inches) deep, all interconnected by wet desert ground. In places the streamlets widened and became very shallow as they flowed over large flat rocks, then regrouped, narrowed and regained speed. "Little Warm Spring" was not a spring, so much as a complex of streams and seeps.

This area was remarkable for the way the wetland abruptly became desert—a hand's width spanned the change from green, sedge wetland to brown, dry desert (Figure 1, see on p 108). At some parts of the wetland's boundaries the vegetation was bizarrely mummified with a thick encrustation of evaporated salts. Clearly, the water was extremely high in dissolved compounds. (We measured the pH to be approximately 7.) This did not presage success for our *Utricularia* search.

After several hopeful starts, we were running out of places to look. We were confident that our *Utricularia*, whatever species it was, would prefer quiet, motionless waters, but we had searched the few bodies of still water with no luck. We had even searched the places where the water flowed swiftly through the grasses, hoping to find plants that had been washed out of some pond that eluded us—still, no luck. Finally, out of desperation, we started searching the rapidly flowing streams. Much to our surprise, there in the fast moving water we found it: fat, sassy *Utricularia*!

Once we revised our idea of where to look, finding plants was easy! The plants grew thickly all along the edges of the streamlets, tumbling and waving in the water. Where the streamlets widened and became shallow the *Utricularia* draped over the large rocks (Figure 2, see on p 108). It was plentiful, vigorous and thriving. The plants were plump, with densely packed leaves that branched frequently. The stolons were thick and sturdy. The bladders were transparent and while they were catching some material, it was not in large quantities. We wondered if the traps were being triggered by the action of the streams, but when we pulled the plants from the water we could hear the traps discharging. There were no flowers, scapes or any indication of flowering parts. Even so, the plants seemed healthy, robust and happy with their environment.

After a few minutes of close inspection we were almost certain that these plants were *U. macrorhiza*. However, they differed from the *U. macrorhiza* we have seen at numerous other sites in the USA and Canada. They were not nearly as long (at most, 60 cm or 24 inches long), branched more frequently (Figure 3, see on p 110) and were an uncharacteristic bright, light green. The leaves were less feathery, more compact and sturdy, and the stolons were unusually brittle. *Utricularia macrorhiza* plants usually have traps that are blackish or reddish, but these plants had transparent, light green bladders. We thought at first that these peculiar features might have been a response to living in a rapidly flowing, riparian situation. However, these characteristics were exhibited by all the plants we found, even the ones growing in fairly calm areas.

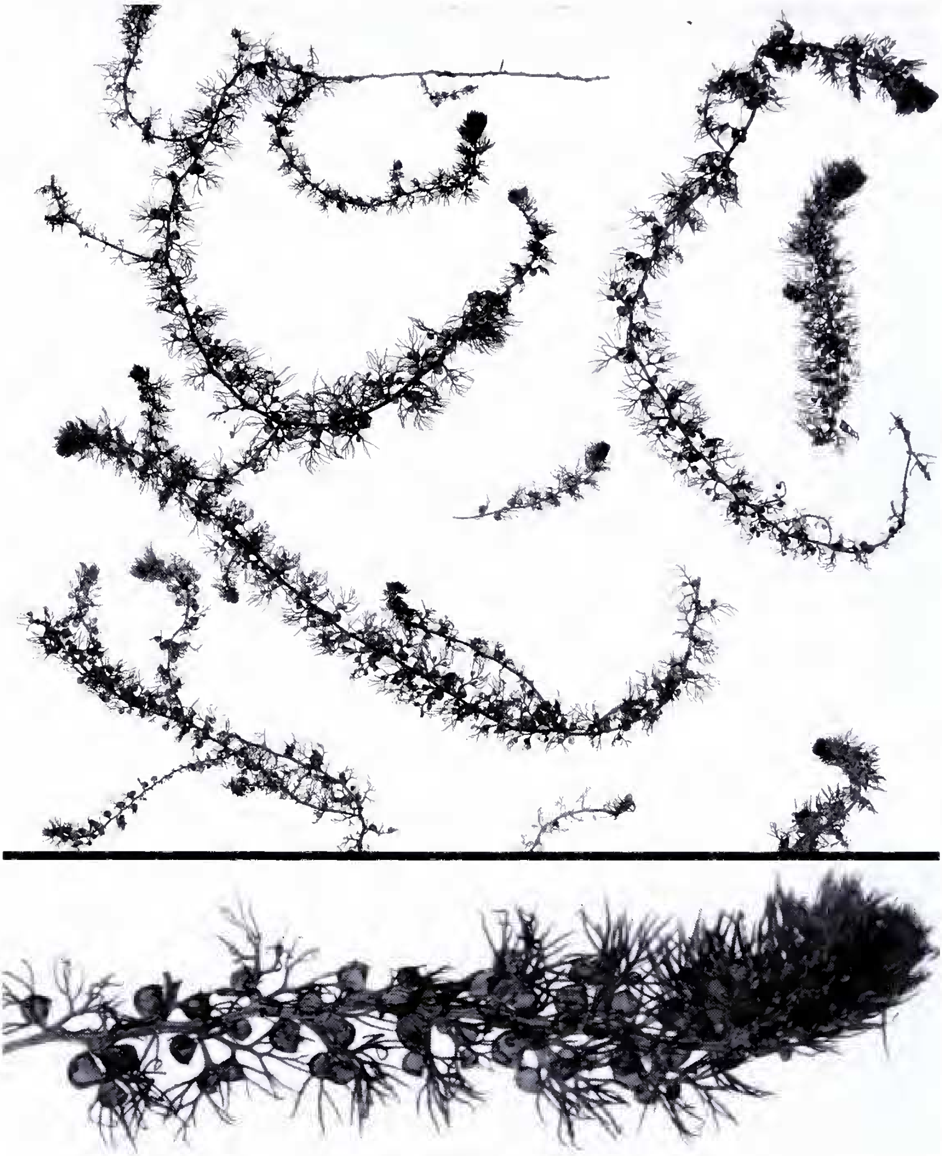

Figure 3: Details of Duckwater *U. macrorhiza* herbarium specimen (DAV 138712). Figure prepared by B. Rice.

such, we believe the peculiar features of the Duckwater plants are either genetically fixed or are a response to the obviously high concentration of dissolved salts in the water.

We took numerous photographs of this amazing site, and then collected and pressed herbarium specimens. Upon returning to California we studied their quadrifid glands—tiny organs inside the *Utricularia* bladders. While the overall form of *Utricularia* can be dramatically modified by environmental effects, the quadrifid glands are much more stable, and can be used to reliably identify many species. Under a microscope, we saw that the quadrifid glands were those of *U. macrorhiza*. This convinced us: the strange Duckwater plants were a peculiar variant of *Utricularia macrorhiza*. We mounted the specimens and deposited them at the Davis Herbaria (California) where skeptics may come, one and all, to be thrilled by the sight of wetland plants from the desert.

Despite the quite conventional results of our expedition (another *Utricularia macrorhiza* site), we still marvel at the peculiarities of the Duckwater habitat. Not only has this acid-loving plant found a way to survive in the alkaline Great Basin Desert, but this species, which is usually restricted to ponds and lakes, has found a way to survive in a rapidly flowing stream. Not bad for a boring old *Utricularia*!

Acknowledgements

The authors would like to thank the Shoshone people at Duckwater for granting us permission to botanize on their land.